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GEOPHYSICAL VARIABLES AND BEHAVIOR: LXXX. PERIODICITIES AND ENERGETIC CHARACTERISTICS OF A STROBE-LIGHT LUMINOSITY DURING A GEOMAGNETIC STORM [1]

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Summary.—A videotape of a "strobe-light" luminosity that occurred in northern Ontario for several minutes during the evening of 6 October, 1994, at the time of a geomagnetic storm, was analyzed frame by frame. Brightness of the flashes decreased over the time of the observation. The interflicker intervals displayed phase-shifted periodicities that would be compatible with a rotating electromagnetic dipole and with the observations of the witnesses. The time of the occurrence and the dynamics of the luminosity were consistent with the predictions of the tectonic strain hypothesis.

The tectonic strain hypothesis (Persinger, 1976, 1990) predicts that most unusual luminous displays, often labelled as Unidentified Flying Objects, are natural phenomena. They are associated with accumulating stress and strain release within a geological region. Derr and Persinger (1986, 1990) have shown that, within large areas of space, reports of luminous displays precede increased incidence of earthquake activity within weeks or months. A significant proportion of these luminosities were temporally contiguous with increased global, geomagnetic activity if sufficient strain existed (as inferred from subsequent earthquake activity) within the geological region (Persinger, 1985).

Spatial-temporal characteristics of the individual event have been predicted on the basis of basic physical principles (Persinger, 1984). Experimentally induced microluminosities, generated when piezoelectric rocks are fractured by gradually increasing applied stresses, exhibit lifetimes in the range of milliseconds. These microluminosities exhibit episodic releases of energy (perceived as light) during their brief lifetimes. If the relationship between experimentally induced luminosities and a comparable form of natural luminosities involves similar physical principles and the effects are scale invariant, then the physical characteristics of macroluminosities should be (ultimately) predictable.

[1]Thanks are given Mr. Daniel T. Mann for his resourcefulness to videotape and his courage to report this interesting phenomenon. Thanks to Diane Hughes Mann (not related) for her intuitive thoughts and reactivation of a forgotten hypothesis. Please send reprint requests and correspondence to Dr. M. A. Persinger, Center in Mining and Mineral Exploration Research, Laurentian University, or Department of Psychology, Laurentian University, Ramsey Lake Road, Sudbury, Ontario, Canada P3E 2C6.

For approximately 3 to 4 min. between 2130 hr. and 2230 hr. on the evening of 6 October, 1994, two men witnessed and videotaped (Sony 8-mm camcorder) an anomalous event about 50 km south of Timmins, Ontario. One of the men was an experienced (Korean War) veteran. They were members of a small hunting team who were camped in a sandy region near a local lake.

The sky was overcast and the ceiling was estimated to be about 1500 m. The luminous flicker was first viewed as a very bright, stationary, pulsating object. It then moved quickly and erratically (zig-zag trajectory) from west to east and involved a sector that would have been equivalent to 45° (of the 360° that would be associated with a complete circle around the observer). The phenomenon was perceived to move towards the south and to descend from a high altitude over a hill on which trees grew ("hovered over the treeline"). The luminosity moved erratically, remained stationary for about 1 min., moved in the same direction towards the north, then ascended quickly to a higher altitude and exhibited more erratic movements. At this point the camera failed and no longer recorded. The phenomenon then accelerated vertically ("at an unbelievable speed") through the clouds.

The luminosity was reported to be saucer-shaped with brilliant white lights pulsating from the top and the bottom. After the observers had excluded possible explanations on the bases of their experience with aircraft, they concluded the phenomenon was alien. Subsequent to the phenomenon, the battery of the camper in which the men were sleeping was observed to have been depleted. There was no report of "missing time," amnesia, or other anomalies that often accompany proximity to luminosities.

Aurorae boreales were noted the following night when the sky was clearer. According to Geomagnetic Indices Bulletin, the provisional aa (average antipodal) values (in nanoT) for the northern hemisphere during the first 12 days of October were 9, 32, 99, 54, 66, 57 (the day of observation), 69, 35, 22, 34, 36, and 28, respectively. The 24-hr. period within which the observation was made was ranked (in the Bulletin) as one of the five days with the greatest geomagnetic activity for that month.

The videotape was analyzed frame by frame. The material was dubbed to tape in betacam SP format for playback at the university studio. The video-processing amplifier was adjusted from unity to enhance the contrast and to minimize the colour noise for the slow analysis. The playback was from a Sony BVW-10 videorecorder, controlled by a Sony RM-450 and viewed on a panasonic BT-1300 monitor on the Y-C channel. Although the term "frame" is employed, each image was a field. "Interlaced video" employed two interlaced fields to create one frame during normal playback. This factor was accommodated when the real time of each frame was calculated.

The most conspicuous property was a quasiperiodic enhancement of

light emission with no obvious shape that was evident in only one frame for 95% of the light emissions and in two contiguous frames for the remaining cases. Between frames the phenomenon was discriminable within the background noise only as a pinpoint movement through the constant field of minute disparities observable on the magnetic tape. The following information was collected: (1) the numbers of frames between successive flashes, (2) the number of frames in which each appearance was observed (1 or 2), and (3) the relative brightness of the flash (maximum, attenuated). The total numbers of frames between flashes were used to calculate time (msec.). The equivalent frequency (Hz) of the flashes was calculated by dividing the duration in msec. between flashes by 1000 msec.

The interstimulus intervals (time between flashes) during the 130 successive emissions of light are shown in Fig. 1. Autocorrelations were completed for each of 25 successive lags. To attenuate the effects of outliers Spearman *rho* correlations were employed. The only statistically significant (set at $p < .01$) values of *rho* occurred for lag 1 (–0.40), lag 3 (0.42), lag 4 (–0.36), lag 6 (0.21), lag 7 (–0.21), lag 10 (–0.23), lag 12 (0.24), lag 13 (–0.31), lag 16 (–0.24), and lag 17 (0.26). A lag of 3 means, for example, that the longer the interstimulus (flash) interval on any given segment the longer the interstimulus interval three flashes later.

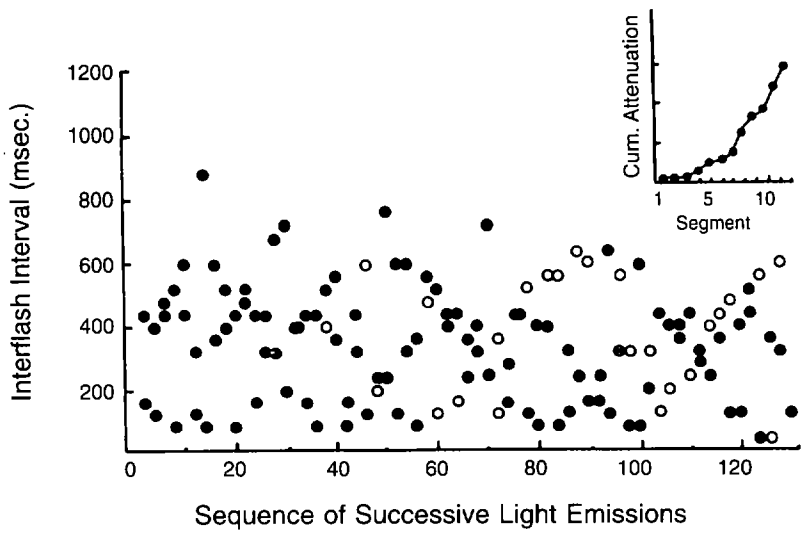

FIG. 1. Interstimulus (flicker) intervals during the 130 successive flashes of the phenomenon. The open circle indicates an attenuated intensity of emission. The upper-right panel is the cumulative number of attenuated emissions per segment (containing 10 sequences) during the observations.

To discern changes in the brightness of the flash over the period of observation the number of times the flash was bright or attenuated over progressive segments each composed of 10 successive sequences were calculated. As can be seen with the cumulative record (upper-right panel) in Fig. 1, with time the strength of the flashes decreased. During the first 30 sequences, all of the flashes were bright while during the last 30 sequences only 66% of the flashes were bright. The Mantel-Haenszel test for linear association (11.01) was significant ($p < .001$); the equivalent correlation coefficient was −.37; the Spearman value was −.29.

The numbers of successive frames (1 or 2) within which the phenomenon occurred were negatively correlated with its brightness ($rho = -.34$, $p < .001$). There was no statistically significant association between the interstimulus interval and either the numbers of successive frames within which the phenomenon occurred ($r = -.15$) or its brightness ($rho = .10$). The mean and standard deviation of the equivalent frequency of the flashes during the period recorded were 4.9 Hz and 5.0 Hz (range = 1.3 Hz to 30 Hz); the median value was 2.7 Hz. However, the distribution of frequencies was clearly bimodal; 23% of the cases occurred between 2.3 and 2.5 Hz while 16% of the cases were either 10 Hz or 15 Hz.

The occurrence and description of the phenomenon on the Mann videotape are consistent with predictions from the tectonic strain hypothesis (Persinger, 1976, 1990). Temporal contiguity (on the order of one to three days) between a marked increase in global geomagnetic activity and the display of energetic luminosities has been a frequent empirical observation (Derr & Persinger, 1986; Persinger, 1985; Persinger & Derr, 1985). The movement towards and stationary positions over geometric structures, e.g., tops of trees, that encourage the accumulation of electric charge, are also compatible with the model for the behavior of the single event (Persinger, 1984). In fact, the dynamics of this phenomenon, including the quick vertical ascent, have been graphically based upon the tectonic strain hypothesis (Persinger, 1990).

The additional information obtained from the present analysis involves the potential physical processes within the phenomenon. The occurrence of a conspicuous double periodicity of comparable magnitudes within the interflicker times of less than 500 msec. could be associated with the rotation of dipoles from which visible electromagnetic energy is emitted. Considering the energies required, we suggest that the source of the visible light emission is not directly related to the mechanism that produced the hypothesized rotation of this source. This interpretation would be compatible with the subjective observations of the witnesses. However, the phases of the periodicities for the two poles of the dipole were not temporally congruent. The

slower periodicity of higher amplitude could be considered the analogue of a synergistic "beat."

The likelihood that all of the periodicities were associated with motor (muscle) artifacts as the camera person contained and lost the moving phenomenon within the viewing field is minimal in light of the symmetry of the periodicity. However, the occasional outliers (Fig. 1) that involved much longer latencies may have involved such artifacts. Because the camera failed during the recording of the luminosity, we cannot exclude the possibility that the periodicities could have been associated with intrinsic factors that controlled the tape speed.

We suggest a possible basis for the erratic movements of the luminosity. Were the phenomenon rotating about an axis and the electromagnetic dipole through which the light was emitted was displaced from this axis, erratic movement would occur. The extent of the irregular movement would have been a function of the congruence in angle between the axis of the electromagnetic dipole and the axis of rotation. Whereas erratic movements would occur during maximum discrepancy between the axes, maximum congruence would be associated with linear movement or stationary activity.

The physical mechanism for this specific event remains unclear. One metaphor (Persinger, 1980) involves a marked distention within the process that we at present identify as a geomagnetic flux line. The distention would result from highly localized distortions in the flux line given the marked geomagnetic activity and infusion of solar plasma. According to this metaphor the distention is contained and extruded, analogous to cleavage and fusion of the linear increments of neurotubules and fibrils that form some synaptic vesicles.

The immediate trigger for this hypothesized process would require a sudden accumulation of energy within a very local space (Persinger & Lafreniere, 1977) or a sudden impulse from ionospheric events that could have originated at magnetically conjugate locations (Campbell, 1967). They are defined as pairs of conjugate points (opposite ends on the surface of lines of force). Candidates would have been a highly focal impact and input from a discontinuity in the density of the solar wind or passage through sector boundary within the interplanetary field, or a very energetic man-made event. Review of the available data indicated that a probable nuclear explosion occurred on 7 October, 1994 at 0325 Universal Time at 41.55 N longitude, 89.07 East. However, the time of this probable nuclear explosion would have been one hour after the observations recorded on Mann's videotape and not consistent with a simple conjugate solution.

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